UNIVERSITY OF CALIFORNIA
COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION
BERKELEY, CALIFORNIA

CIRCULAR 352
July, 1942

GROWING AND HANDLING CANTALOUPES AND OTHER MELONS[1]

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FROM A RATHER meager beginning in about the year 1900, cantaloupe production has become important to California. With increasing centralization of the crop in the West because of favorable environment and improved transportation, this melon is now near the top of the list of truck crops produced in this state; its total annual cash value is exceeded only by that of lettuce and tomatoes.

This circular gives general information on the culture and handling of cantaloupes,[4] particularly for growers who lack experience under California conditions.

IMPORTANCE OF THE INDUSTRY

California dominates in the production of cantaloupes: each year from a third to nearly half of the entire cantaloupe acreage of the United States is located here, and well over half the carlot shipments of the nation originate within the state.

Annually 40,000 to 50,000 acres of California farm lands are devoted to cantaloupes, about 75 per cent being localized in the Imperial Valley. During the past few years (table 1), however, the plantings in that valley

[1] This circular supersedes Circular 308, *Cantaloupe Production in California*, by J. T. Rosa and E. L. Garthwaite.

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[4] The term "cantaloupe" as generally used in the United States designates the small, green-skinned, netted muskmelon of the species *Cucumis Melo* var. *reticulatus*. The term "other melons" as used here will designate types whose cultural requirements resemble those of cantaloupes—namely, Honey Dew, Honey Ball, Persian melon, and Casaba, which are classified as *C. Melo* var. *inodorus*. These melons, though grown extensively in limited areas in California, are not usually included in the term "cantaloupe." To simplify the following discussions, however, the term may be considered to include all the types mentioned above except where specific varieties are given.

have decreased some 10,000 acres, primarily because of powdery mildew and periodically unfavorable markets. The acreage elsewhere in the state, however, has remained rather static, holding the average annual planting to well over 40,000 acres.

The annual income from the cantaloupe crop as influenced by yield and market price has fluctuated much more widely from year to year than has the acreage planted. The annual cash return for the last thirteen years has ranged from a little over 7 to about 9 million dollars, with an average annual value over the thirteen-year period 1927 to 1939, inclusive, of a little over 8 million.

CANTALOUPE DISTRICTS

Although cantaloupes may be grown throughout most of the state, production is centered in the warm interior valleys, where environmental conditions favor high quality.

Imperial Valley.—About 30,000 acres, or three fourths of the state's acreage, is planted annually in the Imperial Valley. Of this acreage 35 to 40 per cent is "extra early" or "covered," the seed being planted in December or January, with about 80 per cent of the early acreage grown under paper caps and about 20 per cent given brush protection. The remainder of the acreage (the "open" crop) is planted in February and March. Shipments normally begin near the middle of May and continue until about July 15.

Kern and Tulare Counties.—In Kern and Tulare counties, at the southern end of the San Joaquin Valley, planting usually extends from about March 1 to April 15, and the shipping season comes during July. The greater part of the crop is planted in the open. The acreage in these counties varies widely from year to year. The time elapsing between the Imperial Valley crop and that of more northern areas is ordinarily short; this allows a brief period when these growers have the advantage of an open market.

Turlock District.—Located in the northern part of the San Joaquin Valley, the Turlock district is particularly favorable to high quality. Much of the acreage is devoted to Honey Dew, Casaba, and Persian melons because of competition for the cantaloupe market by some of the more southern areas of the state and by other states. Planting is usually from March 15 to April 15.

Sacramento Valley.—Cantaloupes can be successfully grown in the northern end of the Sacramento Valley. The acreage, however, is limited by competition on the market at the time when the crop matures. The planting season usually includes the period between April 15 and May 15.

TABLE 1

ACREAGE AND CASH VALUE OF CALIFORNIA CANTALOUPE CROP, 1927–1940, INCLUSIVE*

Areas	1927–1936		1937		1938		1939		1940	
	Acres	Value, dollars	Acres	Value, dollars	Acres	Value, dollars	Acres	Value, dollars	Acres	Value, dollars
Imperial Valley	37,430	6,041,000	29,887	6,891,000	28,000	5,440,000	32,254	5,154,000	26,100	4,216,000
Other†	12,640	2,228,000	9,000	2,080,000	10,150	1,983,000	11,200	2,157,000	12,150	2,079,000
Total	50,070	8,269,000	38,887	8,971,000	38,150	7,423,000	43,454	7,311,000	38,250	6,295,000

* Data compiled from: Yearbooks of Agriculture, United States Bureau of Agricultural Economics; California State Bureau of Agricultural Statistics; and California Coöperative Crop Reporting Service.

† The data for "other" areas include Honey Dew, Honey Ball, Casaba, and Persian melons.

SOIL AND CLIMATE

Land used should be free from nematodes and from toxic amounts of alkali. Though not tolerant of high concentrations of soluble salts, melons in California thrive best on soils neutral or slightly alkaline; they are among the plants most benefited by application of lime to acid soils.[5]

Cantaloupes may be grown on a great variety of soils. Muck or peat, however, is never used for melons; and heavy clay and adobe are generally avoided. The crop is grown most extensively on sandy or sandy loam soils, as in the Turlock district; and on soils of sedimentary origin, as in the Imperial Valley. The soil should be well supplied with organic matter, be fairly fertile, and be well drained. Where early production is desirable, the soil should be one that warms up rapidly in the spring; good drainage and open texture are therefore required. Heavier soils are better adapted to the later crops than are light soils.

Cantaloupes require a frost-free growing season. Warm nights with hot days induce the best development. The plants are easily killed by frost and comparatively high temperatures are required for both germination and subsequent growth. Environment has a marked effect upon development and quality. Low relative humidity of the air during ripening favors formation of thick, coarse netting and of solid fruit flesh—two characteristics necessary for good shipping quality. Low humidity, without rain, also tends to prevent the fungus diseases that often defoliate the plants in humid sections. The maximum amount of sunshine produces high sugar content, solidity, and fine flavor. Hence cantaloupe culture on the Pacific Coast is generally limited to the interior valleys.

FERTILIZERS

The kind and quantity of fertilizer needed for cantaloupe production depend largely on the type and condition of the land. Since little definite information exists as to the fertilizers that could be profitably used in California, only careful local tests can determine the proper practice.

As was early recognized, generous amounts of humus or organic matter in the soil are essential to the proper growth and development of melons. Voorhees,[6] discussing fertilizers, states that all vine crops "seem to require an abundance of vegetable matter in the soil in order to make their first growth. Hence upon soils deficient in this respect manures should be applied which are rich in vegetable matter."

[5] Hartwell, B. S., and S. C. Damon. Comparative effect on different kinds of plants with liming and acid soil. Rhode Island Agr. Exp. Sta. Bul. 160:407–46. 1914.

[6] Voorhees, E. B. Fertilizers and manures. 335 p. The Macmillan Company, New York, N. Y. 1898.

As a matter of fact, most of the soils in the arid interior valleys of California are particularly low in organic matter and therefore in nitrogen. Barnyard manure is considered valuable in raising melons. In its absence, however, one can usually grow a profitable crop of cantaloupes for one year and sometimes longer after plowing up alfalfa. On land not previously in alfalfa, where manure is not available, the quickest and cheapest way of supplying organic matter is a clover, cowpea, soybean, or sesbania covercrop. In turning under a covercrop, mix the material with the soil by disking, then plow it under, and irrigate the land to promote rapid decay.

In some sections of the state, especially on light soils, increased yields have been obtained with commercial fertilizers. In the Imperial Valley the common practice is to apply 90 to 135 pounds of phosphoric acid per acre (equivalent to 500 to 750 pounds of single-strength superphosphate or proportionately less of the more concentrated forms) just before bedding the soil. Although no uniform fertilizer practice is employed in other melon sections, growers sometimes apply a complete fertilizer containing nitrogen (N), phosphoric acid (P_2O_5), and potash (K_2O). The analyses used vary considerably. As a rule, one application of 400 to 600 pounds to the acre is made just before planting. In general the use of a complete fertilizer for melon culture may not always be essential, since on most California soils vegetable crops respond primarily to nitrogen. Local experience is the best guide. According to comparative tests in this state and elsewhere, a second light application of 15 to 30 pounds per acre of nitrogen just before the plant begins to send out branches more than justifies the extra cost.

Fertilizer may be applied by hand or drilled in with a corn or cotton planter fitted with a fertilizer attachment. A special fertilizer drill may be employed when the beds are being made, or fertilizer attachments may be placed on the drill when the seed is put in the soil. When a second application is made at the time the plants are starting runners, the fertilizer may be applied with a drill, drawn about halfway between the plant and the bottom of the irrigation furrow. Another method is to use, near the plant, a hillside plow to open a furrow in which the fertilizer is scattered by hand or with a drill. A lister should then be used to throw the soil over the fertilizer and to open the furrow for irrigation.

CULTURAL PRACTICES

Dates of Planting.—The planting date for the different localities varies somewhat from year to year because of environmental factors, especially temperature and moisture. Within certain limits, however,

the time of planting for the different sections has become rather definitely established. Melon seeds do not germinate well below 50° F and may be more liable to fungus or insect attack at lower temperatures. The approximate planting dates for the various districts are as follows: Imperial Valley, December 1 to April 1; Kern and Tulare counties, March 1 to April 15; the Turlock district, March 15 to April 15; and the Sacramento Valley, April 15 to May 15.

Preparation of the Soil.—Careful plowing to a depth of 8 to 10 inches early enough in the season to permit the soil to settle thoroughly is essential to successful melon growing. Land that has been in a seed or a cover-

Fig. 1.—Specially constructed bedding machine with three listerlike plows drawn by a tractor of 60 horsepower.

crop the preceding season should be plowed in the summer or fall to allow ample time for decay of the rough material that has been turned under. Land previously in alfalfa can be successfully handled by a shallow plowing followed by double-disking and a deeper plowing within two or three weeks.

When cantaloupes are to follow cantaloupes or other summer truck crops, the beds of the previous crops should be disked down, and the land plowed and smoothed with a float. About a month before planting, the land should be irrigated and then prepared. When cantaloupes are to follow lettuce or other winter truck crops, the beds of the previous crops should be double-disked so that the ground is flat. The soil is generally moist, and the beds may be thrown up without further treatment.

In making beds for cantaloupes, various methods may be employed. The beds are usually first laid out with a lister to which a marker is attached. The lister makes a furrow 8 to 10 inches deep, and the beds are

formed by back-furrowing with a walking plow or with a two-bottom riding plow drawn by a small tractor. In other cases a large track-type tractor drawing six plows and making two half beds at a single operation is used (fig. 1). The south or west sides of the beds are then harrowed and smoothed with a V drag; the seed is planted, and the ground irrigated. If the ground has not been preirrigated before bedding, some growers prefer to irrigate after bedding and before planting. In such cases the beds are disked or harrowed after the ground becomes sufficiently dry; and the south or west sides are firmed, smoothed with a V drag, and planted (figs. 2 and 3).

Fig. 2.—Condition of the land before bedding; also a series of beds, each 6 feet from center to center and about 2 feet high at the apex.

Most growers prefer high beds (2 feet or more at the center) which expose a large surface to the sun, allow the ground to warm up quickly, and afford protection from the wind. High beds also have the advantage that the vines and melons are above the water level during irrigation.

In melon-growing areas where spring planting dates are later than in the Imperial Valley, beds are not generally used. The seeds are planted on the flat in rows 6 feet apart. If it is necessary to irrigate the crop, the seeds are planted at the top along one side of the irrigation furrow. Where sufficient soil moisture is present for seed germination, the irrigation furrows are opened up near the hills or rows just before the first irrigation.

Planting.—There are two general systems of starting the cantaloupe crop. The first method, the one most generally employed, is to plant the seed in hills or by drilling in the field where the crop is to be grown. The

second method, suitable for small acreages where early maturity is the main consideration, involves starting the plants in greenhouses,[7] hotbeds, or cold frames, and then transferring them to the field when weather conditions are suitable. Unless a large ball of earth is also transferred the plants must be set out while very young, since they do not regenerate roots readily.

Where the seed is planted directly in the field, one of several methods may be utilized. Seed may be planted by hand and then covered with a hoe; or by hand planter; or by drilling with either a hand drill or a power drill.

Fig. 3.—Beds that have been cultivated, smoothed with a V in one side, and left ready for planting.

When planting is done by hand, a hoe with a handle about 15 inches long is used. The soil is deeply cultivated with the hoe for 10 to 12 inches around the hill. A hole about 6 inches long, 4 inches wide, and 1 inch deep is then made with the hoe; and into this about ten seeds are dropped to assure a full stand, for later thinning. The seeds are not bunched, but are spread around in the hole. The soil is then firmed over the seed, and a little loose soil placed on top to provide a mulch.

To render hand planters satisfactory, two modifications are needed. One consists of setting a cone in the interior to spread the seed and prevent bunching in the hill. The other modification is attaching a shoe to the outside of the planter to mark the proper depth of planting. With such a hand planter, one man can plant about 8 acres a day, whereas he could do only 1 acre daily with a hoe.

[7] Beattie, W. R. Hotbeds and coldframes. U. S. Dept. Agr. Farmers' Bul. **1743**:1–28. 1935.

When the hills are 5 feet apart in each direction, there will be 1,740 hills to the acre; 5 by 6 feet apart, about 1,450; 4 by 7 feet, about 1,390; 5 by 7 feet, 1,240; and 5 by 8 feet, 1,090 hills to the acre.

One pound of seed will plant an acre, although many growers provide 2 pounds. An ounce of cantaloupe seed of average size contains about 850 seeds, or 13,600 to the pound. At the usual planting distance this will provide about ten seeds for each hill—a sufficient amount for a good stand of strong plants.

The late planting—the so-called "open" crop—is usually planted with a drill. It should be possible to get a 100 per cent final stand if the drill operator makes certain that the planter feeds regularly. The drill places all seed at a uniform depth, with uniform packing on top and it spreads the seeds evenly along the bed. Obviously, planting with a drill is far more rapid than planting by hand. An excess of seed is generally used in machine plantings to insure a uniform stand. Ordinarily 3 to 4 pounds of seed per acre is required for the drill method of planting.

The depth of planting varies from ½ to 1½ inches, the depth depending on the type and condition of the soil and the season of the year. Late-season plantings, light sandy soils, and soils not well mulched require deeper planting.

Greenhouses and hotbeds are used for starting cantaloupe plants to some extent in intensive market-garden sections where land values are high and where extreme earliness is desired. If the plants are started under cover with artificial heat, the melons can be ripened one to two weeks earlier, and the period of production lengthened. The usual methods of growing the plants involve use of manure hotbeds, flue-heated beds, or greenhouses.

Cantaloupe plants started in beds or greenhouses require careful watering, ventilating, and thinning. A temperature of 70° to 75° F should be maintained until the seeds germinate, after which a day temperature of 65° to 75° and a night temperature of 60° to 65° are desirable. After moving the plants to the field, one should thin them to two per hill as soon as the roots become established.

Forcing Earliness.—Several methods are useful in hastening maturity of the cantaloupe crop. In the Imperial Valley about 80 per cent of the covered acreage is protected with paper covers (fig. 4). Protected plants mature their crops 4 to 10 days earlier.

Several types of paper covers are available. Those most commonly used are made of glassine or waxed paper. Glassine is generally preferred because it admits more light than parchment or oiled paper. It seems not to hold condensed moisture so late in the morning, and it lessens

burning of the plant. Machine-pressed glassine cones, rigid enough to hold their shape, or plain sheets 16 × 18 inches, supported by a wire brace, are the two most popular types.

Both kinds of covers are placed over the hills immediately after planting. As was stated above, the pressed cones are self-supporting and are held by soil hoed over a flanged edge. Such a cover can be put in place much more rapidly than the glassine sheets; but the latter are considered more efficient and lend themselves more readily to manipulation. To support the sheet type of cover a piece of no. 17 galvanized wire 18 to 24 inches long is bent to form an arch. The ends of the wire are thrust into the ground until the arch is about 4 inches high in the middle and parallel

Fig. 4.—Cantaloupe field with the young plants of each hill covered with glassine paper, as described in the text. (From Cir. 308.)

with the direction of the bed. The paper sheet is then placed over this arch, and the edges are covered with soil to hold it in place. One man can put on 800 to 2,000 a day, according to whether the soil is heavy or light. Galvanized iron wire is used for the arches because it resists rust and can be used for several years.

Shortly before thinning, the covers are lifted at the east end to provide ventilation for hardening of the plants. When the plants are about an inch high the covers are removed, and the plants thinned and cultivated with a hoe. The paper cover is then replaced, but the east end is left open. After the early part of March the east or south side of the cover away from the prevailing wind is left open to admit more air and light to the plants and so harden them before the covers are removed entirely. About April 1, when all danger of frost is passed, the paper caps are removed and burned, and the wires taken up and stored for use the next year. The cost of covering one acre of cantaloupes with paper caps (in-

cluding cost of caps) is about $18 to $20. Under favorable conditions a yield of 150 to 200 crates per acre may be expected with this method.

Brush or brush-and-paper windbreaks are also used to force early growth. A shallow furrow is made along the top of the bed. Posts (grape stakes) are then set at intervals of about 100 feet along the bed. All are slanted over the plants at an angle of about 45° except the two at the end of the bed, which are driven deeper and are usually set erect. One strand

Fig. 5.—Some of the steps in the construction of a brush shelter. The grape stakes have been set at each end of the bed, and a shallow furrow plowed along the apex. The brush is stuck in the furrow as described in the text. The young plants have been thinned, and the glassine paper replaced with the east end open for ventilation.

of no. 8 galvanized wire is attached to the stakes. Brush (chiefly arrowweed) is stuck in the furrow parallel with the grape stakes, 6 to 8 inches apart, and slanted over the plants (fig. 5). Special paper (2½ feet wide, sold in rolls about 1,037 feet long) is placed on top of the brush, resting on the single strand of wire. More brush is now set in place on the opposite side of the paper to alternate with that previously set up. At intervals a single stick of brush may be stuck through the paper and then pressed into the soil to add rigidity to the structure. Finally a second strand of wire is stretched between the stakes to hold the brush and paper in place (fig. 6). The cost of putting brush-and-paper cover on 1 acre of cantaloupes is about $150. Under favorable conditions a total yield of 50 crates per acre may be expected from brushed cantaloupes, a third to a quarter of that obtained by the use of paper covers.

Thinning the Field.—Cantaloupes planted in the field by the ordinary methods will require thinning, since more seed is planted than the number of plants needed. When the plants have a true leaf between the seed leaves they should be thinned, first to about four to a hill and later (in a week or 10 days) to only two in each hill. Plants crowded closely together should be thinned so those left are separated as far as possible; if there is danger of disturbing the roots of the remaining plants, those that are removed should be cut off rather than pulled out. Drill-planted fields are usually thinned to allow one plant to every 2 feet of row.

Fig. 6.—The picture shows the paper covers removed. The young vines, which partially cover the bed, are becoming entangled in the brush. When the vines reach this stage of development the brush shelter is removed, provided the danger from frost has passed.

Spacing apparently has a decided influence on the total yield of the marketable melons. In Frazier's experiments[8] in Arizona, plants of the variety Powdery Mildew Resistant No. 45, thinned to 5, 8, 10, 12, 15, 20, 25, and 30 inches in the row, with beds 6 feet apart, gave the following results, based on one year's experiments: Marketable yields were highest and roughly alike at the 5- to 12-inch spacings, with a consistent and significant decrease in yield as spacings increased beyond 12 inches. Though the wider spacings gave earlier maturation of fruit, they also produced the lowest percentage of marketable melons, mainly because of sunburn. There was a tendency toward larger melons at wide spacings, though the differences were not significant. These results suggest that closer spacing than is customary in California might be desirable.

Cultivation.—The cultivation of cantaloupes for the control of weeds should begin as soon as the rows of plants can be followed. The soil should be loose, mellow, and free from weeds until the spread of the

[8] Frazier, W. A. Fruiting of the Powdery Mildew Resistant No. 45 cantaloupe as affected by spacing. Amer. Soc. Hort. Sci. Proc. 37 (1939) :831–35. 1940.

vines makes further working impracticable. Since the cantaloupe is rather shallow-rooted, with roots often extending farther than the vines, cultivation must be shallow, especially near the hills, after the vines begin to run freely. When the hills are carefully check-rowed, cultivation can be given in both directions during the early part of the season by means of any shallow-working cultivator. When the plants begin to spread, cultivation should be carried on in one direction, and the vines kept trained in a more or less compact row. During the last cultivation the vines are sometimes turned back by hand, or a vine lifter is attached to the cultivator in order to work closer to the plants. It is common practice to lift the vines out of the irrigation furrow to prevent the wetting and subsequent spoiling of the melons.

Early in the season, while the plants are small, and at intervals after the vines have begun to develop, hand-hoeing will be required in order to remove the weeds that cannot be destroyed by machine cultivation. About six workings with machine tools and two to four hand-hoeings are required to grow a crop properly.

Growers often inquire about the advisability of pruning cantaloupe vines to increase fruit set or to hasten maturity. Little is gained by pinching or heading back cantaloupe vines grown out of doors. Reducing the number of fruits on a vine will increase the size of those that remain; but since most varieties produce melons too large for a standard pack, such thinning will prove to be a loss rather than a benefit.

Growers frequently ask why the early blossoms on their cantaloupe vines do not set fruit. Cantaloupe blossoms are of two kinds, and those that first appear will produce pollen only. Flowers that bear pistils and produce fruit appear later. This fact accounts for the failure of the first blossoms to set fruit. At the base of the pistillate or fruit-bearing blossom is located the small, undeveloped melon formed before the blossom opens. Pollen must be transferred by bees or other insects to the pistils of these flowers. In most varieties the flowers that produce the fruit contain both stamens and pistils, which are the male and female parts of the flower. After a few fruits have set on a vine, this burden makes such a heavy demand for food and other substances in the plant that the later flowers fail to set.

IRRIGATION[9]

Irrigation is essential in practically all the cantaloupe districts of California, especially in the hot interior valleys where most of the melons are grown. The principles of irrigation and soil moisture seem to be

[9] The section on irrigation was prepared by L. D. Doneen, Assistant Irrigation Agronomist in the Experiment Station, and John H. MacGillivray, Assistant Professor of Truck Crops and Associate Olericulturist in the Experiment Station.

similar for cantaloupes and for other truck crops and deciduous fruits.[10] The frequency of application and the amount of water needed will depend on the amount of available water the soil can hold, the depth and thoroughness of root development, and the evaporating conditions or climate. When a soil is irrigated, the water moves downward by the force of gravity and leaves the moistened soil at "field capacity." Plant roots are able to obtain water from the soil at an adequate rate to keep them supplied until the plant wilts. This condition of soil moisture is termed the "permanent wilting percentage" of the soil. All plants can remove the water from any given soil to approximately the same percentage soil moisture. The difference between field capacity and permanent wilting percentage is the amount of water readily available to the plants. One may ascertain the permanent wilting percentage of the soil in the laboratory and greenhouse by the use of growing plants; or in the field of growing crops by determining soil moisture at frequent intervals until a soil-moisture content is reached where the water cannot be obtained by the roots without great difficulty. This condition is evidenced by marked wilting. Soils differ in the amount of readily available water they can hold. In general, sands can hold the least and clays the most, although there are some exceptions. In most areas of California, winter rains or preirrigation may fill soils with moisture to field capacity. High temperature, low humidity, and high evaporation are conditions that cause the greatest moisture loss (transpiration) from plants.

Irrigation trials have been made at Davis for three years with cantaloupes on a deep Yolo fine sandy loam. This soil has a field capacity of 16 per cent, a permanent wilting percentage of 7. Plants have been grown without irrigation provided that at the time of planting soil moisture was at field capacity throughout the future root zone. Two of the treatments were the use of different amounts of irrigation water applied in broad low furrows; another treatment involved the application of the water by flooding before the first ripe fruit was picked.

The application of a total of 6 inches of water at Davis has given maximum yields. The unirrigated plot was lower in yield of marketable fruit by 19 to 40 per cent. None of the treatments had any marked effect on the soluble-solids content of the fruits. The loss of fruits from the flooded plot by rotting ranged from 0.7 to 3.0 per cent of the marketable fruit. Cantaloupe plants are usually rooted in the top 4 feet of soil, and they will penetrate most of the soil between the rows to about this depth.

[10] For more complete discussion of principles and terms used in irrigation see: Veihmeyer, F. J., and A. H. Hendrickson. Essentials of irrigation and cultivation of orchards. California Agr. Exp. Sta. Cir. 50:1–34. Revised, 1936. (Out of print.)

Before maturity of the first set, the cantaloupes were flooded without injury. This method insures that all the soil will be wet to the desired depth. With a single furrow, on the other hand, only the soil below the furrow and for a short distance on either side is wetted, while the remaining soil between the irrigation ditches remains dry. This condition naturally reduces the volume of soil wetted. As has been demonstrated, growth is uninterrupted until checked by lack of moisture, but wilting occurs when the soil in contact with the roots is reduced to the permanent wilting percentage. Wilting is frequently not observed, but will occur first in the oldest leaves near the crown or base of the plant. If the supply of soil moisture is nearly depleted, but wilting has not occurred, an irrigation will replenish the water supply before the plants are injured.

Before development of runners, the plant requires relatively small quantities of water because of the limited leaf area or transpiring surface, and probably no early irrigation will be needed except on extremely light sandy soils. After the runners are well developed, the plants have a large leaf area through which water is rapidly lost, especially where there are strong winds. This, accordingly, is the critical period in soil moisture. On heavy soils two or three irrigations of 4 to 6 inches each may be required. Lighter soils are irrigated more frequently.

DETERMINATION OF MATURITY

It is generally agreed that fully mature melons are the most desirable from the consumer standpoint. Such melons have more sugar than immature fruit and are superior in flavor and texture. It was difficult, in the past, to determine the proper stage of maturity to harvest cantaloupes for shipment east. Two rather recent developments have simplified this problem: (1) with modern methods of refrigeration, especially with the practice of precooling the cars before loading, melons can be harvested ripe and yet reach the distant markets in good condition; (2) most of the recently introduced strains are well adapted to handling and transportation after fully maturing on the vine.

External Signs of Maturity.—Fortunately nature has provided an excellent yardstick to gauge the ripening process. As the cantaloupe approaches maturity, a slight crack develops at the point where the stem is attached to the fruit. When this crack completely encircles the attachment of the stem, the melon is at the "full-slip" stage, ready for harvest. Cantaloupes intended for local market can safely be left on the vine until they have reached this stage and, in addition, have acquired a slight yellowish tinge. For distant transportation, however, such fruit is much more subject to molds and decay than fruit harvested earlier. Another

handicap of melons picked when the skin has turned yellowish is their tendency to become soft and to lose flavor rapidly after reaching the higher temperatures in retail markets.

Melons harvested at the half-slip stage—that is, when about half or three fourths of the stem breaks free from the melon with the application of slight pressure—are generally inferior in quality to full-slip melons either when harvested or after transportation to distant markets.

Changes in netting and color are other external signs of maturity. As melons approach the ripening period the corky layer known as the "net" becomes noticeably elevated and very hard. The skin between the nets turns from light gray to a decided yellowish tinge. At this stage melons are suitable for immediate use.

A definite relation has been shown to exist between the stage of maturity at harvest and the comparative market behavior of the cantaloupes after distant transportation. The extensive experiments of Pentzer, Wiant, and MacGillivray[11] have contributed much useful information. In commercial practice three grades are ordinarily used to designate maturity. These grades are based on (1) the condition of the stem at the point of attachment to the fruit (the slip), (2) firmness of the melons, and (3) their color. "Fancy" melons are those harvested at one-half to three-quarters slip; they are firm, hard, green, and totally unfit for immediate use. "Hard-ripe" melons are those harvested at three-quarters to full slip; they are firm and show only a slight yellow tinge, if any. "Choice" melons are full slip, yellow, but not soft; they are usually trucked to local markets.

Table 2 shows the comparative behavior of these three market grades after transportation from the Imperial Valley to New York City; the variety Powdery Mildew Resistant No. 45 was used. This table indicates, as Pentzer, Wiant, and MacGillivray have pointed out, that the hard-ripe melons have the most desirable consumer qualities after being shipped a long distance. Usually, therefore, the fruits should be harvested at this stage. Under certain conditions, however, some variation toward either the fancy or choice grades may be advantageous or even necessary.

Internal Changes as the Melon Approaches Maturity.—Every grower, shipper, or other worker with cantaloupes should keep in mind two important points. First, the sugar, flavor, and texture of the melon improve rapidly until it reaches full slip, after which there is a definite tendency toward a reduction in sugar, although flavor and quality may increase

[11] Pentzer, W. T., J. S. Wiant, and John H. MacGillivray. Market quality and condition of California cantaloupes as influenced by maturity, handling, and precooling. U. S. Dept. Agr. Tech. Bul. 730:1–73. 1940.

TABLE 2

COMPARATIVE MARKET BEHAVIOR OF FANCY, HARD-RIPE, AND CHOICE CANTALOUPES AS DETERMINED BY AND AVERAGE OF TEST LOTS IN 11 CARS*

Maturity at harvest	Per cent of melons in the various firmness ratings				Firmness factor†	Per cent of melons in the three color classes			Color factor†	Per cent of melons with objectionably hard flesh	Aroma score†	Flavor score†	Per cent of melons showing mold	Per cent of melons showing decay
	Hard	Firm	Ripe	Soft		Green	Yellow green	Yellow						
First day after unloading														
Fancy	40	47	13	0	44	47	48	5	53	54	32	58	0	0.0
Hard-ripe	9	55	36	0	57	2	48	50	85	23	43	62	0	.4
Choice	2	39	59	0	65	0	1	99	99	10	57	61	2	3.0
Third day after unloading														
Fancy	0	45	54	1	64	2	62	36	78	0.9	47	62	0.4	2.0
Hard-ripe	0	25	72	3	70	0	15	85	95	2.0	54	63	7.0	11.0
Choice	0	14	83	3	72	0	0	100	100	0.9	56	60	14.0	25.0

* Data from: Pentzer, W. T., J. S. Wiant, and J. H. MacGillivray. Market quality and condition of California cantaloupes as influenced by maturity, handling, and precooling. U. S. Dept. Agr. Tech. Bul. **730**:1–73. 1940.

† The scale used for determining the firmness rating, the color score, the aroma score, and the flavor score follows:
Firmness rating: hard=25, firm=50, ripe=75, and soft=100.
Color score: green=33, yellow green=67, and yellow=100.
Aroma score: 25=none, 50=low, 75=medium, and 100=high.
Flavor score: 50=inedible, 55=poor, 60=low fair, 65=high fair, 70=good, 75 or higher=very good.

slightly. Second, melons severed from the vine before full-slip stage do not increase in sugar content during transportation. They may soften, however, to some extent and become slightly more palatable. On these two points the experimental evidence is clear and unmistakable. The practical applications are obvious: green melons cannot be expected to gain in sugar content during transit to the East. It is distinctly advantageous to both grower and consumer that melons be harvested at the three-quarters to full-slip stage.

The Determination of Sugar Content (Percentage of Soluble Solids).— It is extremely difficult to find a single accurate index to quality in cantaloupe fruits. Several factors are involved, especially sugar content, flavor, aroma, and texture. Chace, Church, and Denny[12] have demonstrated a close relation between the eating quality and the percentage of soluble solids as determined with the Brix spindle and with the immersion refractometer. The percentage of soluble solids varies directly with the sugar content of the juice, since nearly all the soluble solids present in the juice are sugars. The hand refractometer is an accurate and convenient tool for determining the refractive index of the juice; it measures directly the percentage of soluble solids present.

Scott and MacGillivray,[13] by means of the hand refractometer, have investigated the variation in soluble solids. They found that individual melons vary considerably in composition, according to the part of the fruit from which the sample was obtained. Samples from the stem end, for instance, were consistently one or two units lower in percentage of soluble solids than samples from the blossom end of the same fruit. Unless some care is observed, a reading from a single sample will not adequately represent an average for the whole melon. According to Scott and MacGillivray the two most satisfactory methods of obtaining the percentage of soluble solids of a fruit are to press the juice from the entire portion of the edible flesh or to press the juice from a longitudinal segment. In each case a uniform percentage of the flesh must be removed.

Under field conditions a convenient and rapid method is to cut the melon longitudinally and sample the juice from the flesh about midway between the rind and the seed cavity at a point halfway between the stem and blossom ends. Although this method probably does not give so reliable an index as the two methods mentioned above, it is accurate enough for selecting melons for high sugar content.

[12] Chace, F. M., C. G. Church, and F. E. Denny. Relation between the composition of California cantaloupes and their commercial maturity. U. S. Dept. of Agr. Dept. Bul. 1250:1–26. 1924.

[13] Scott, G. W., and John H. MacGillivray. Variation in solids of the juice from different regions in melon fruits. Hilgardia 13(2):69–79. 1940.

The practical importance of the hand refractometer is that it enables inspectors and others charged with preventing the movement of immature melons, to determine conveniently whether a particular lot should be condemned as too immature for human consumption, or allowed to enter wholesale and retail channels. Growers and shippers will find the refractometer very useful. Its proper application should enable them to check closely on the condition of their melons, and will aid materially in reducing the work of the law-enforcement officials.

To pass inspection, according to the Agricultural Code of California, the juice of the edible portion of the cantaloupe must contain not less than 8 per cent of soluble solids as determined by the Brix-scale hydrometer. This regulation applies to cantaloupes produced in the area north and west of the San Gorgonio Pass. In the area south and east of that pass (the Imperial and Coachella valleys) the juice must contain at least 10 per cent of soluble solids.

The edible portion of the Honey Dew melons produced north and west of the San Gorgonio Pass must contain not less than 10 per cent soluble solids as determined by either the Balling or Brix-scale hydrometers. In the area south and east of that pass, the juice of the Honey Dew must contain at least 11 per cent of soluble solids. The edible portion of Honey Ball melons must contain not less than 12 per cent soluble solids regardless of the area in which they are produced.

HARVESTING, GRADING, AND PACKING

Harvesting.—During the peak harvest periods it is the common practice to go over the fields every third day or, in extremely warm weather, each day. It is highly desirable to harvest during the early morning. Picking should be completed by 10 to 11 a.m., and only in emergency should melons be harvested after midday. Melons harvested early are cool and turgid. It takes appreciably more ice to cool melons harvested during the warmer parts of the day than those harvested early. Delay involves extra expense and is a valid reason for early-morning picking. Logically, fruit harvested while cool and promptly placed in refrigerated cars may be expected to surpass in quality fruit not so handled.

For harvesting, a type of sack common in the citrus industry is used. This sack may be opened at the bottom by unlatching a hook. Each worker is responsible for harvesting the mature fruit from a single bed. Upon reaching the end of the bed he deposits his load in crates scattered at regular intervals throughout the field. Where low-bed field wagons or pneumatic-tired trailers are used, he walks up a slanting plank to the conveyance and deposits his load on the floor of the wagon or trailer.

Wagons or trailers used for hauling cantaloupes should be well padded on the sides to prevent excessive bruising. In most cases the melons are hauled to a central packing shed for grading and packing. Sometimes, however, the temporary field packing shed is still used, the melons being hauled directly to the shed in either wagons or crates and, after packing, trucked to the railroad for loading into refrigerator cars.

At present, trailers with pneumatic tires are ordinarily used for transporting the melons from the field to the packing shed. The trailers are loaded directly with fruit and towed in pairs to the central packing shed by trucks. At the shed the trailers are taken along a slightly banked driveway so that they come to rest with the lower side toward a conveyor

Fig. 7.—Left, cantaloupe shed, showing the arrangement for discharging the melons from the trailers to the conveyor belt. The trailers are hauled to an inclined bank, one side is released, and the melons rolled out by gravity. Right, the cantaloupes, released from the trailers, roll to the conveyor belt on the left.

belt (fig. 7). A retaining board on the trailer is released; this allows the melons to roll onto the conveyor belt, by which they are carried past the graders and sorters.

Grading and Packaging.—Although there are no rigid standard grades for cantaloupes other than size, the classification based on maturity into "choice," "hard-ripe," and "fancy" (as defined in an earlier section) should be used to a greater extent. This system gives the buyer some concrete idea of the type of stock he is likely to get.

As the melons pass along the conveyor belt before the individuals doing the grading, they are sorted carefully. Cracked, decayed, bruised, or immature fruits and "slickers" (melons with poorly developed netting) are discarded.

Melons are graded rigidly according to size. In the trade, cantaloupes are designated by the type of the package and by the number of melons a particular package contains (table 3).

Packing.—There is now a distinct trend away from the practice of

packing cantaloupes in temporary field sheds. Under the most efficient arrangement the melons are loaded directly into trailers and towed to the central packing shed. These latter sheds are usually designed with sufficient flexibility to be used for lettuce and carrot packing in the winter and spring. At the beginning of the cantaloupe season, with some shifting of equipment, a shed can be altered to take care of this crop.

Figure 8 shows a cantaloupe-packing shed capable of handling 2½ cars per hour with a maximum of efficiency and economy. As in the previous description, the melons released from the trailers are taken by

TABLE 3

NUMBER OF MELONS CONTAINED AND THE INSIDE DIMENSIONS OF THE VARIOUS TYPES OF PACKAGES*

Name of pack	Container number of shook	Number of melons in pack	Inside dimensions of package, inches
Pony cantaloupe crate	40	45 or 54	11 × 11 × 22⅛
Standard cantaloupe crate	39	45, 3 tiers of 15 each 36, 3 tiers of 12 each 27, 3 tiers of 9 each	12 × 12 × 22⅛
Jumbo cantaloupe crate	41	45, 3 tiers of 15 each 36, 3 tiers of 12 each 27, 3 tiers of 9 each	13 × 13 × 22⅛
Standard cantaloupe flat	42	9, 12, or 15 in 1 tier	4 × 12 × 22⅛
Special cantaloupe flat	43	9, 12, or 15 in 1 tier	4½ × 13⅛ × 22⅛
Special cantaloupe flat	44	8, 9, 11, or 12 in 1 tier	5 × 14 × 22⅛

* Extracts from the Agricultural Code of California. Revised to August 27, 1937.

conveyors past the graders and sorters. Marketable melons of comparable size and maturity are selected by the graders and placed in bins. The bins are arranged in a series opposite the grader. The melons roll toward the lower end of the bin, where the packer operates. When he has finished, the crate is placed on the conveyor and goes to the lidder. After the lid is nailed on, the conveyor system transports the crate to a place inside of the refrigerated car, where it is set in the proper spot by hand.

Wrapping.—In general, growers and shippers find that the wrapping of cantaloupes is not desirable, necessary, or economical. As McKay and his co-workers have demonstrated,[14] wrapping promotes spoilage. Some shippers, however, wrap an exterior layer or several layers to make the crate more attractive.

Waxing and Gassing.—Pentzer and his co-workers,[15] in comprehensive experiments to test the efficiency of wax treatments of melons to retard

[14] McKay, A. W., G. L. Fisher, and A. E. Nelson. Handling and transportation of cantaloupes. U. S. Dept. Agr. Farmers' Bul. 1145:1–20. 1921.

[15] For citation see footnote 11, p. 16.

ripening and decay during transit and the market period, had variable results. They concluded that no advantage is gained from commercial wax treatment. Experiments by the same investigators to test the effect of nitrogen trichloride in preventing decay in transit led to essentially the same conclusion as that reached for wax treatments. The gas did not affect the rate of ripening or the flavor; nor did it accomplish its purpose—the control of decay in transit.

Precooling.—For transportation to eastern markets, cantaloupes are ordinarily loaded into precooled refrigerated cars, which are generally

Fig. 8.—Interior of a melon-packing shed. Sorters are shown placing the melons in bins; in the middle foreground is a packer; and at the right are packed crates on the conveyor going to the car.

re-iced several times in transit. An average car holds about 300 crates of cantaloupes.

Pentzer and his co-workers have thoroughly investigated the problems involved in transporting cantaloupes from the Imperial Valley to eastern markets. If their results are applied as widely as they deserve to be, refrigeration practice should become standardized with reference to the maturity of the melons transported. These workers found, for example, that (1) it was unnecessary to precool "fancy" cantaloupes for shipment east, because precooled melons of this maturity arrived on the New York market unfit for immediate use; (2) precooling proved almost always to be good insurance against overripeness and decay in "hard-ripe" melons; (3) "choice" melons required precooling to 45° F or lower in order to arrive without loss from decay or overripeness.

The same investigators, after testing the relative efficiency of three types of precooling apparatus now in use, have recommended methods for estimating rather accurately the amount of cooling accomplished. To quote: "The cooling accomplished with the types of portable fan equipment used in these tests could be estimated fairly well (1) by the amount of ice melted, 4.3° reduction in temperature being obtained by the meltage of 1,000 pounds of ice; (2) by the length of time the precooling fans were operated, estimating an average temperature reduction of 3.6° per hour; or (3) by reading the temperature of melons in the crates in the top layer of the doorway stack near the lengthwise center of the car. The cooling obtained with a truck-mounted, two-cylinder, 7 by 7 inch ammonia compressor averaged 4.2° per hour, or about the same as was effected by melting ice at the rate of 1,000 pounds per hour in cars cooled with fans and ice."

As these investigators stress, only a thorough precooling can accomplish the purpose. It takes time to precool a car of cantaloupes properly. To lower the temperature of such a car from an initial 90° F to 50° requires the meltage of 9,300 pounds of ice and 11 hours' operation with portable fan equipment. The same lowering of temperature with a mechanical refrigerating unit would require 9½ hours of operation.

SEED PRODUCTION

The importance of good reliable seed in cantaloupe production cannot be overestimated. Poor germination, resulting in defective stands, and a high percentage of off-type plants are two disturbances traced to the seed source. To produce the best seed takes considerable skill, experience, and expense. The various strains and varieties of cantaloupes are readily cross-pollinated among themselves. Cantaloupes also may be cross-pollinated with Persians, Honey Dews, and Casabas. They will not cross with cucumbers, gherkins, watermelons, squash, or pumpkins. Bees are the most effective pollinators of melons. As these facts indicate, a plot to be effectively isolated should be located a quarter of a mile or more from the nearest source of contamination.

A very large proportion of the cantaloupe seed crop is produced in the Rocky Ford area of Colorado. The average yield varies from 175 pounds to 225 pounds of seed per acre. Seedsmen when providing acreage for their needs estimate the yield at about 200 pounds per acre.

Seed fields are planted and cared for much as if they were to be harvested for shipping. In fact, some fields are so harvested, and then the later melons and culls are cut for seed; but this practice, being obviously undesirable, is not followed by reliable vine-seed growers.

It is important to rogue the seed fields carefully for off-type plants, diseased plants, and melons whose size, shape, or netting may not be typical of the variety or strain. As most seedsmen realize, however, only a limited improvement of a variety can be expected from roguing diseased and off-type plants. A sound practice is to base the stock-seed improvement program on a series of inbred lines that have proved superior in comparative tests.

Formerly much of the seed acreage was harvested with a mechanical separator. At present there is a distinct tendency to return to hand-cutting, which permits a certain amount of selection. It is customary to make three or four pickings of each field. The melons are placed in piles, cut, and the pulp emptied into a bucket; later the seed and pulp are transferred to barrels. The mixture of seed, pulp, and juice is allowed to ferment for one or, in some cases, two days. It is then washed, and the light seed and pulp are floated off. After the washing, the seed is transferred to trays with screen bottoms and is placed in the sun to dry. Usually, before the seed is sent to growers and retailers, it is put through a cleaning mill to remove debris and any light seed that may not have floated off in washing.

VARIETIES

Before discussing cantaloupe varieties we may well consider the ideal type of fruit from the standpoint of grower, shipper, and consumer. To meet the requirements of these groups the fruit should be round to slightly oval, well netted, and free from deep sutures. The size should be such that a high percentage of the crop will pack 45 to the standard crate. The flesh should be smooth and nonfibrous, with high sugar content. Growers in general prefer strong, vigorous vines with good foliage that will protect the melons from sunburn damage.

All varieties of *Cucumis Melo* are known as muskmelons. The species is divided into several botanical varieties; the green-skinned netted melons, classed as variety *reticulatus,* are known in this country as cantaloupes. Botanically speaking, the term "cantaloupe" should be applied only to melons with a rough, warty surface, deep sutures, and hard rind; these types belong to the botanical variety *cantaloupensis.* But this variety is not grown in this country, and the word "cantaloupe" has come to signify any muskmelon with a netted surface and shallow sutures (that is, variety *reticulatus*). The winter melons comprise a third commercially important group. They are classified botanically as variety *inodorus* (lacking odor) and are smooth or ridged, non-netted, late maturing, and able to keep well in storage. This group includes the Honey Dews and Casabas.

Upwards of 120 varieties of muskmelons are cultivated in the United States. Of this number about 25 have commercial importance. In California about 12 are produced in quantity. These are described on the following pages.

The Hale's Best Group.—The variety Hale's Best was introduced in 1924. Its development was the result of the alertness and enterprise of Mr. I. D. Hale of California, who obtained the original seed from a Japanese melon grower near Brawley, California. Though its origin is uncertain, it is thought to have resulted from a chance cross between the salmon-tinted Pollock 10–25 and the variety Emerald Gem.

Fig. 9.—Cantaloupes of the variety Powdery Mildew Resistant No. 45. The flesh is exceptionally thick; the cavity small and dry.

The original strains of the Hale's Best were not very uniform; many rough, irregular, and large fruits were to be found. Now that selection by seedsmen has largely corrected these faults, several highly uniform strains are available such as No. 112, Hale's Best Jumbo Strain, and No. 9–36. The cavity is above medium in size, and the melons tend to produce a high percentage of Jumbo 36 sizes. The variety is the earliest maturing of this group.

Powdery Mildew Resistant Cantaloupe No. 45 is a strain developed by the United States Department of Agriculture and the California Agricultural Experiment Station, primarily to meet the need in the Imperial Valley, where powdery mildew (caused by *Erysiphe cichoracearum*) threatened to ruin the industry. A factor, or factors, for resistance to the mildew was found in muskmelon material brought from India. These imported melons, being of no commercial value, had to be hybridized with good commercial types. They were crossed with Hale's Best, and several generations of selection and backcrossing resulted in the release of Powdery Mildew Resistant Cantaloupe No. 45 in 1936.

This melon, an ideal shipping type, does well wherever the Hale's Best types have proved satisfactory and where the new (race 2) form of the mildew is not prevalent. It is slightly oval, well netted, with deep salmon-orange flesh and a dry cavity (fig. 9). The flesh is very thick, solid, and well flavored. It can be harvested at "full slip" without danger of becoming soft and overripe before reaching the consumer. The strain produces many melons of the 45 Standard size, but when grown for late-season maturity the fruit tends to become rather large.

In 1939 appeared a new biological race of the powdery mildew organism, to which No. 45 was very susceptible.[16] In the Imperial Valley, at

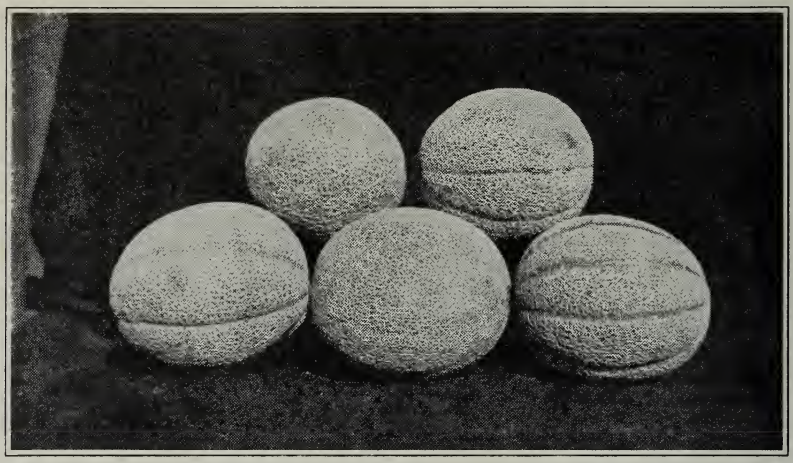

Fig. 10.—Cantaloupes of the variety Powdery Mildew Resistant No. 8. Typical melons have shallow sutures, and are heavily netted except in the sutures.

present, No. 45 cannot be planted safely because of the mildew situation. In other districts where powdery mildew is not a serious threat, No. 45 can be used with success.

The origin of the strain Powdery Mildew Resistant Cantaloupe No. 8 is not clear. There is some evidence that it may have originated in the experimental plots of the United States Department of Agriculture in the Imperial Valley. Seed became available in 1933, and a limited acreage has been planted in the Valley since that date. The melon is larger than No. 45 and of about the same shape. It is well netted except for the sutures, and the sutures are shallow. The flesh is salmon-orange, with some whitish mottling. It has a characteristic strong flavor, and the cavity is small but "wet." This strain has been used chiefly for the early "brush"

[16] Jagger, I. C., T. W. Whitaker, and D. R. Porter. A new biologic form of powdery mildew on muskmelons in the Imperial Valley of California. U. S. Dept. Agr. Plant Disease Reporter 22:275–76. 1938.

acreage in the Imperial Valley. It will produce fair-sized, early melons, usually of poor quality. The vines, very strong and prolific, are not damaged so badly by the new biologic race of powdery mildew as No. 45. Several strains are available; most of them are alike, except for minor variations.

The Perfecto Group.—The Perfecto melon, developed by J. R. Edwards of Rocky Ford, Colorado, and first grown between 1920 and 1924, has found a definite place in some sections as a late-maturing melon. The

Fig. 11.—A cantaloupe of the Tip Top, or Bender, variety. Note the sparse, coarse net and the broad, smooth sutures.

melons are oval, well netted, and smaller than No. 45. The flesh is thick, rich salmon-orange, with characteristic flavor and aroma. Seed is offered under several names, such as Superfecto, Improved Perfecto, Perfected Perfecto, AZ Melon; these strains appear to be practically identical. If the melons are harvested slightly after "full slip" or even at "full slip," the flesh tends to become watery, and to break down under transportation. For this reason growers are inclined to harvest "on the break," and the melons are apt to be inferior because of premature harvesting.

The Tip Top Group.—The variety Tip Top, or Bender, is the only one of this group used to any extent as a local market melon in certain parts of southern California. As it does not hold up well under rough handling or distance transportation, it should be planted only for home garden and local market use. It is large, oval, and salmon-fleshed, green near the

rind. The melons are ribbed and sparsely netted, with broad, shallow sutures. Quality and flavor are excellent.

The Persian Group.—The variety commonly known as Persian melon is supposed to have been introduced into the United States by the Armenians. In California it has become very popular as a local market melon, grown chiefly in the Sacramento and San Joaquin valleys. In the warmer, drier climate of the Imperial Valley it does less well and never attains acceptable quality.

The Persian is among the larger muskmelons; it ranges from 7 to 10 inches in diameter. It is globular, without sutures, and is covered with

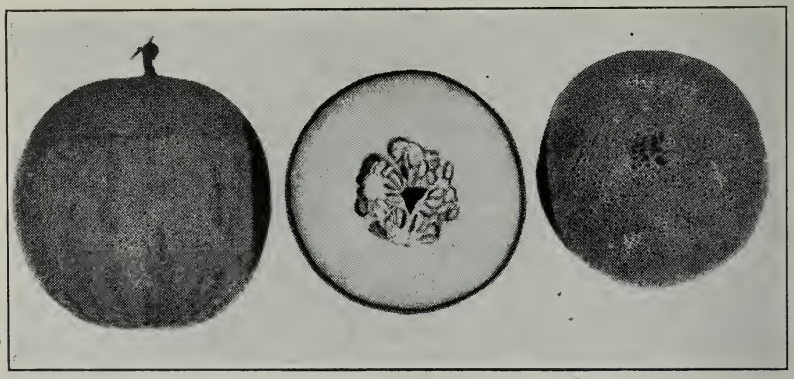

Fig. 12.—Baby Persian melons. The fruits have a small, compact, dry seed cavity and exceptionally thick flesh.

a rather fine gray net. The flesh is thick, pink, and generally of good texture and flavor. The melons are usually harvested when they soften slightly at the blossom end; or for nearby markets they can be left on the vine until "full slip." Persians harvested for shipment should be cut rather than pulled from the vine just before the change in ground color. It is felt that this procedure reduces the amount of rot that may develop during transit. Recently several strains of Persian have been introduced that are smaller (4 to 5 inches in diameter) and more uniformly shaped than the original strains. The "Baby Persian" developed by the University of California and the United States Department of Agriculture (fig. 12) is one of the smaller strains and is resistant to race 1 of powdery mildew. Typical melons are small (6 to 7 pounds), with very fine net and attractive skin color. The flesh is thick, of very good quality, and the seed cavity is small.

The Turkish melon is another variety within this group. It is oblong and ribbed, with very light net; otherwise it resembles the Persian.

Fig. 13.—Honey Dew melons. The fruits have a smooth skin, greenish-white flesh, and a rather large seed cavity.

The Winter-Melon Group.—Honey Dew is among the most popular of the late-maturing types known as winter melons. Grown in France for many years under the name White Antibes, it was introduced in this country about 1915. The vines make a very heavy growth and are usually strong and vigorous. The melons are round, large (6 to 8 inches in diameter), and smooth, with no sutures and with ivory-white skin (fig. 13). In most strains of Honey Dew the stem does not separate from the fruit upon ripening, as it does in the netted melons; maturity is judged by change in skin color and by softness at the blossom end. As maturity is

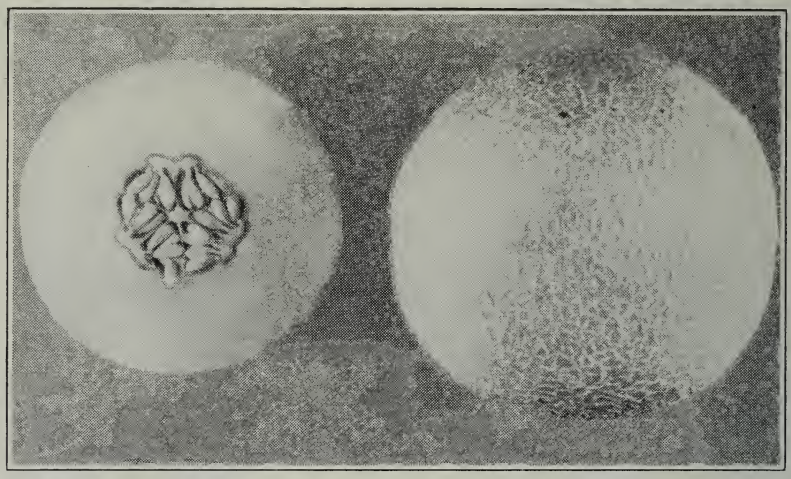

Fig. 14.—Honey Ball No. 306. Note the small, tight, seed cavity and the thick flesh.

approached, the skin color changes from greenish or ivory white to a creamy white, and streaks of yellow may appear. The melons require a long growing season, mature late, and keep well in storage.

Two distinct types of Honey Ball are of some importance. The original strains are finely netted, white, round, and green-fleshed. They are small (4 to 5 inches in diameter) and very prolific. In appearance they are a small counterpart of the Honey Dew, with some netting. The "pink-meat" Honey Balls are somewhat larger (5 to 7 inches in diameter), mostly globular, covered with light, fine netting. The skin is white or light gray, and turns yellow at maturity. The flesh is thick and deep pink, and the cavity is small. There are several strains of the latter type—Weaver Special, Globe de Oro, Melo Gold, Honey Ball 306, and others. These types should not be harvested until a slight pinkish tinge is evident through the netting that covers the "ground spot."

Honey Ball 306, released in 1940 by the University of California and the United States Department of Agriculture, is resistant but not immune to both races of powdery mildew. It is a very firm, solid, white-skinned, lightly netted melon with attractive orange flesh and with a very

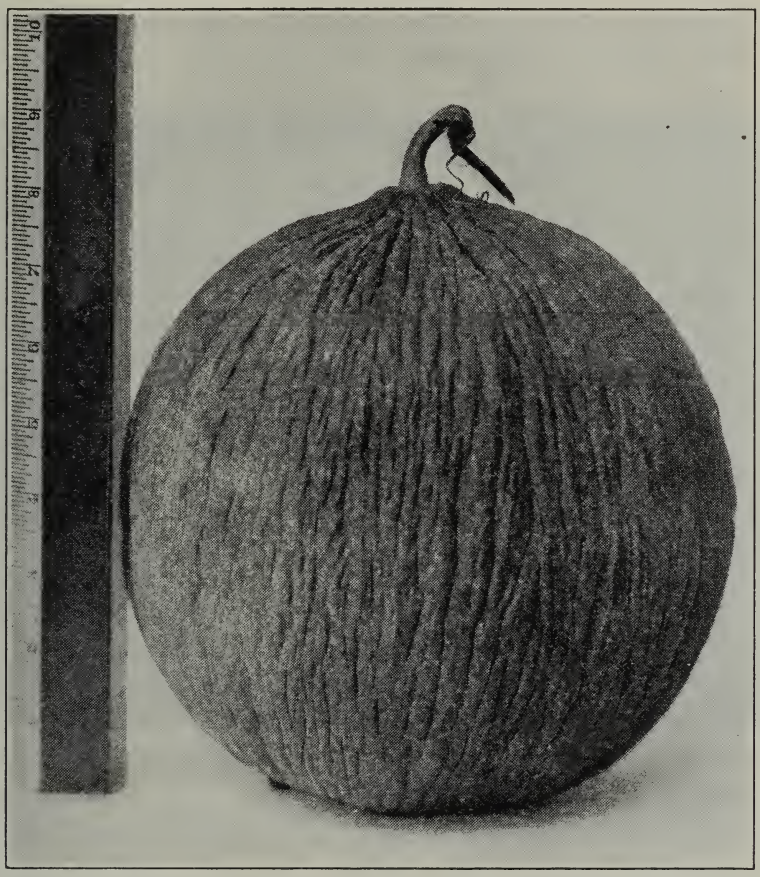

Fig. 15.—Golden Beauty Casaba. Note the absence of netting and the deep corrugations, which give the melon a wrinkled appearance.

small dry seed cavity (fig. 14). The foliage is not quite so heavy as is desirable, and under adverse conditions there is a tendency for the melons to become "sugar-cracked" and sparsely netted.

The name Casaba is applied to a group of large winter melons very distinctive in texture and flavor. They are harvested by cutting the stem when reasonably mature and are stored till the blossom end becomes soft. As a rule the flesh is less sweet than that of the Honey Dews or Honey

Balls. Of the several varieties, only two are important in California. The Golden Beauty Casaba is popular for both home garden and local market use. It is a large melon (7 to 9 inches in diameter), with a smooth, lemon-yellow skin. It has deep furrows or sutures, and a tough rind (fig. 15). The flesh is thick, juicy, and white.

The Crenshaw melon (fig. 16), a Casabalike variety, has become very popular in the San Joaquin Valley during the past two years. It appar-

Fig. 16.—The Crenshaw variety, a new melon in California of unknown origin. It has comparatively smooth skin; the shape is very distinctive.

ently has real merit as a home-garden and local-market melon. Its value for shipping has yet to be demonstrated. The melons are oblong, smooth, or very finely netted. The skin is dark green, turning yellow at maturity.

INSECT AND OTHER PESTS OF CANTALOUPES[17]

The pests of cantaloupe are not so numerous or, in general, so severe as those of certain other truck crops. Sporadically, however, especially in the early stages of growth, plantings are severely stunted and even killed by local pests. As the plants develop and become less succulent, the number of potentially injurious insects is greatly reduced.

[17] This section on insect pests of cantaloupes was prepared by S. F. Bailey, Assistant Professor of Entomology and Assistant Entomologist in the Experiment Station.

Cutworms.—Young plants in localized areas of a field are often killed by various species of cutworms. Since such larvae usually feed at night and hide under clods or in the soil during the day, they are seldom seen. Where only a small area or a few hills are involved, many growers merely replant. If, however, a considerable area is damaged and the cutworms are not full-grown (about 1½ inches long) the use of a poison bran bait is advisable. There are several formulas for such pests, but one which has proved fairly successful is as follows: bran, 25 pounds; paris green or white arsenic, 1 pound (or liquid sodium arsenite, 1 pint); molasses, 2 quarts; and about 3 to 4 gallons of water. The given amounts should be accurately measured, since an overdose of the poison makes the mash distasteful to the cutworms. The arsenic (paris green or sodium arsenite), together with the molasses, should be dissolved in about 2 quarts of water. This concentrated mixture, thoroughly stirred, should be added to the remainder of the water and poured slowly over the bran while it is being stirred with a flat stick or paddle. The final mixture should be moist enough to stick together when squeezed but not wet enough for water to drip from it. About one handful sprinkled on each hill in the early evening is advisable for the best results.

Seed-Corn Maggot.—Under conditions of delayed germination or in damp, cool weather, seed-corn maggots sometimes attack the seeds and tiny plants. Hand-watering with a solution of mercuric chloride, 1 ounce to 8 gallons of water, 3 to 4 days after replanting or transplanting, followed (if need be) by two additional treatments about 10 days apart, usually will give good results. If replanting is done under favorable germination conditions, chemical treatment of the soil is usually not needed.

Wireworms.—In the late winter and spring, wireworms, like seed-corn maggots, attack the seedlings and often destroy sizable plantings. The value of soil treatment with chemicals is questionable. As the moisture in the surface soil dries up, the wireworms usually work deeper in the ground and cause less trouble to the replants. Infested soil should not be planted to cantaloupes, or two or three years should elapse between plantings of this crop.

Nematodes.—The garden or root-knot nematode readily attacks cantaloupes, particularly in sandy soils. These invisible "worms" form galls or "knots" on the small roots and cause severe stunting or death of the plants. There is no satisfactory method of chemical control. Infested soil should not be planted to cantaloupes. The development of resistant varieties appears, at present, to be the only solution.

Melon Aphid.—Among the most common species of plant lice found on cantaloupes is the small, dark-green form called the melon aphid. Small

colonies of aphids are first seen on young plants near the tips of the runners or in the growing point. They have a tendency to cluster on the underside of the leaves and to curl them badly. The infestation increases so rapidly that the plants are soon stunted or killed. Early infestations should be eliminated as soon as observed; the infested plants should be destroyed or "spot-dusted."

Nicotine dusts of 2 per cent strength (equivalent to 5 per cent Black Leaf 40) give good results when applied with a hand, power, or traction duster. On truck crops, dusts are more generally used, because of their ease and rapidity of application. Sprays made up of nicotine sulfate (Black Leaf 40, ¾ to 1 pint per 100 gallons of water with a small amount of liquid spreader) or 4 per cent rotenone, are, however, also satisfactory. With either a dust or a spray, care should be taken to reach each colony of aphids in the growing points and on the underside of the leaves. Once the leaves are badly curled, satisfactory control is almost impossible.

Cucumber Beetles.—The green-and-black beetles, often called *Diabrotica,* some spotted and some striped, are familiar to every grower. They fly readily and often migrate into cultivated areas from alfalfa, ditch banks, and uncultivated lands. Preferring the more tender, succulent portions of the plant, they soon chew the leaves full of holes and scar the runners and young fruits. Control is difficult because of the migratory habit of the beetles and the ease with which they are disturbed during control operations.

One of the most widely used dusts for these beetles is cryolite (about 50 per cent strength). Other dusts such as calcium arsenate are also used; and, more recently, a commercially prepared mixture of pyrethrum and thiocyanate (Lethane 384) has proved very satisfactory as a contact poison. Dusting should not be done during the warmer part of the day when the beetles are most active. Also, care should be taken that no poisonous residue is left on the fruit at harvest.

Flea Beetles.—These small, jumping beetles, usually bronze or metallic blue-black, feed on the leaves in the same manner as cucumber beetles. Fluosilicate dusts applied particularly to the new leaves keep down this pest satisfactorily.

Red Spider.—During hot weather, red spiders often attack cantaloupes, especially if the plants are suffering from lack of water. The leaves turn brown and papery, and the plants will die quickly unless control measures (and irrigation) are practiced at once. Dusting sulfur alone has never been entirely satisfactory for red spiders; and, up to the last year or two, little else could be recommended. Now, however, a new type of insecticide commonly known as "dinitro," employing dinitro-*o*-

cylohexylphenol or related compounds, has been developed. This material (at a strength of 1 per cent) is very effective against red spiders. Excessively heavy applications should be avoided and great care should be exercised in using these materials because some of them will seriously burn melon plants. If the webbing and dust on the leaves is not severe, 20 to 25 pounds of dust per acre should be ample, with good dusting equipment.

DISEASES OF CANTALOUPES[18]

Powdery Mildew.—The disease known as powdery mildew (figs. 17 and 18), caused by the fungus, *Erysiphe cichoracearum,* is perhaps the

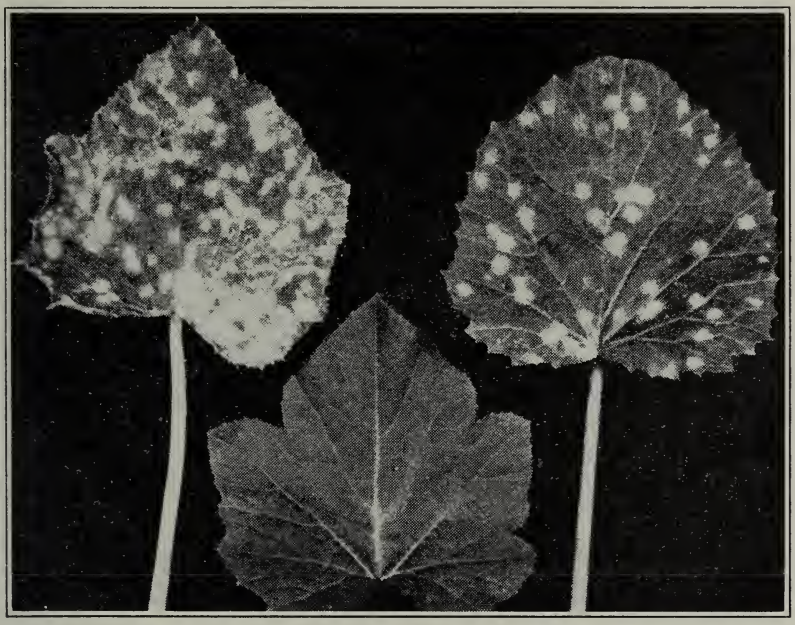

Fig. 17.—Powdery mildew of cantaloupe. A healthy leaf is shown in the center.

most serious disease of melons in the state; the most damage occurs in the Imperial Valley. The disease first appears early in the season, usually in March, and becomes worse as the season progresses. The leaves and often the stems of infected plants are covered with the white growth of the fungus; such plants become stunted or weakened, and produce few melons, of inferior quality. The infected leaves and stems turn brown, become brittle, and die.

Resistant strains of cantaloupes released several years ago such as No.

[18] The section on diseases of cantaloupes was prepared by John T. Middleton, Junior Plant Pathologist in the Experiment Station.

45 have proved less satisfactory since the appearance of a strain of the fungus that is capable of infecting them. No. 8 is less susceptible than No. 45. New melon varieties are being developed for resistance to this new strain of powdery mildew.

According to tests conducted to determine methods for the fungicidal control of powdery mildew on cantaloupe, although sulfur dusts afford excellent control, dusted plants are more severely injured by the sulfur than they would have been by the disease. No satisfactory results have yet been obtained from copper-containing dusts. Powdery mildew can be controlled satisfactorily by copper-containing sprays used with a suit-

Fig. 18.—Powdery mildew of cantaloupe. The younger leaves and parts of the stem are covered with white powdery growth of the fungus; older leaves are killed.

able wetting agent. Such materials as ammoniacal copper, bordeaux mixture, burgundy mixture, and yellow copper oxide have given adequate control. Whether the yield increase warrants the use of these materials is questionable. Growing resistant varieties of melons is the most desirable method of combating this disease. In the absence of resistant melon varieties, planting cantaloupes near squash infected with powdery mildew should be avoided wherever possible.

Downy Mildew.—Downy mildew of melons is caused by the fungus *Pseudoperonospora cubensis.* This disease is distinct from powdery mildew and should not be confused with it. Whereas leaves and stems may be white with powdery mildew, the leaves affected with downy mildew at first show only yellow spots, which later enlarge and become dark brown or black. The fungus eventually kills the leaves. There is a further difference in that the downy mildew fungus develops on the underside of

the leaves as a blue-gray growth, whereas the powdery mildew fungus is white and not confined to the lower surface of the leaf. Downy mildew is most prevalent in the southern coastal areas of the state. This disease may be controlled by 3–3–50 bordeaux applied with a suitable wetting agent.

Verticillium Wilt.—In some areas *Verticillium albo-atrum* is present and causes some loss of hills by wilt. The fungus enters the plant through the roots, progresses upwards into the stem and causes a dark discoloration of the woody section of root and stem. First the young leaves at the tip of the runners, then the older leaves, show signs of wilting; later, leaves on infected plants become yellow and chlorotic, turn brown and die; they sometimes even fall off and expose the stems. The disease has been observed on cantaloupe, Casaba, Honey Ball, Honey Dew, and Persian melons; it occurs in San Joaquin County, in the inner coastal valleys, and in the southern coastal plain. Since this fungus attacks a variety of hosts, careful selection of planting acreage devoid of this disease should be made; avoid rotation with eggplant, pepper, potato, and tomato.

Root Rot.—Root rots may be caused by a variety of fungi such as *Fusarium, Pythium, Phytophthora, Rhizoctonia,* and *Sclerotium. Macrosporium Phaseoli* and *Sclerotinia sclerotiorum* are capable of causing not only a root rot but a stem rot, which progresses 10 to 12 inches above the ground level and causes the infected runners to wilt and later to die. The last-named fungus produces a white cottony growth on roots and stems under favorable conditions; as a result, this disease is often called cottony rot. It is often prevalent on celery, crucifers, lettuce, and a variety of other hosts. *Macrosporium Phaseoli* produces an appressed black growth and causes the disease frequently known as charcoal rot. *Sclerotium Rolfsii* may occur in fields previously in sugar beets. These three fungi produce resting bodies (sclerotia) that enable the fungus to live over in the soil for several years. Root rots are generally favored by heavy soils, excessive irrigation, and poor drainage. If precautions are taken to avoid planting in heavy soils and to irrigate judiciously, and if adequate means are taken to supply proper drainage, root-rot damage will be reduced. Cantaloupes should not be planted on land in which the previous crop was seriously affected with cottony or charcoal rots, nor on land where *Sclerotium Rolfsii* occurs.

The seed- and soil-borne root rot of squash, caused by *Fusarium javanicum,* has not been observed to occur naturally on melons. To avoid the possibility of melons' becoming infected by this fungus, one should not plant them on land in which squash has been affected with fusarium root rot.

Fruit Rot.—Although most of the fruit rots of melons are market diseases, a rot of Honey Dew melon (fig. 19), caused by *Phytophthora capsici,* occurs in the field in the central-valley area of California. Infected fruits at first have small brown or water-soaked spots, which later enlarge and produce large dark, water-soaked lesions; the flesh when cut is soft, flaccid, and odorless. Excessive irrigations and poor drainage with high temperatures are the principal predisposing factors for

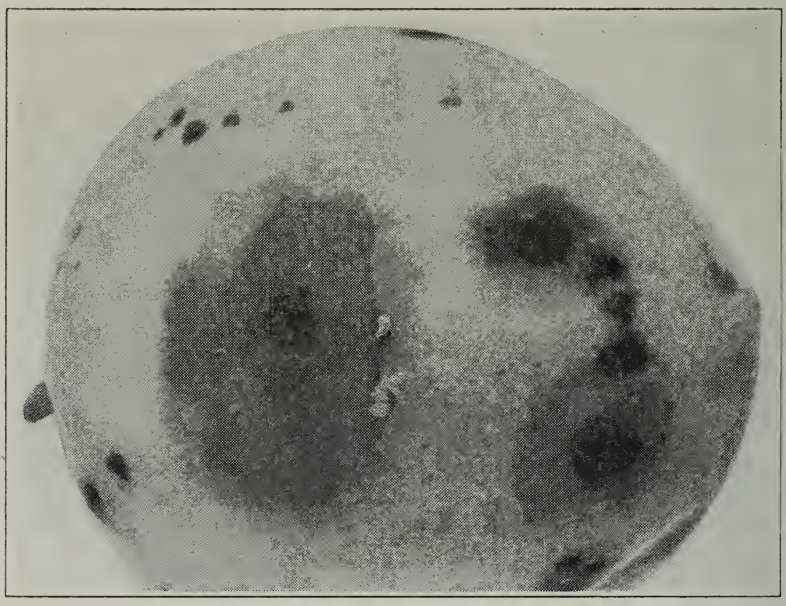

Fig. 19.—Phytophthora rot of Honey Dew melon.

infection. Good drainage and careful irrigation are suggested corrective measures.

Mosaic.—Young leaves of plants affected with the mosaic disease (fig. 20) are stunted, often deformed, mottled with yellow and green, the veins frequently darkened and killed. The runner tips are often stunted, rosetted, and yellowish. All commercially grown melons may be affected. The virus that causes this disease is transmitted largely by means of aphids. One may somewhat arrest its spread by controlling the aphids. Cantaloupes should not be grown near squash plantings.

Curly Top.—Another virus disease infrequently found is curly top of cantaloupe, Casaba, Honey Dew, and Persian melons. The young leaves of infected plants are noticeably stunted and curled, of normal or slightly darker color; the older leaves are generally yellow. The inter-

nodes are much shortened, giving the vines a stunted and bushy appearance. This disease is caused by the same virus as the curly top of sugar beet, but is more injurious to cantaloupes than to beets. It is transmitted by the beet leafhopper.

Fig. 20.—Cantaloupe mosaic, a virus disease spread by aphids. It causes mottling of the leaves and dwarfing of the plants.

Damping-off.—Occasionally young plants wilt and die soon after emergence, or the seedlings may fail to emerge. This condition is called damping-off and is caused by certain soil fungi (*Pythium, Rhizoctonia, Phytophthora,* or *Fusarium*). This trouble may be controlled by dusting the seed with copper or mercury compounds such as red copper oxide (¼ teaspoonful per pound of seed) or Semesan (½ teaspoonful per pound of seed); also by cultural practices conducive to optimum growth.

ACKNOWLEDGMENTS

The authors desire to express their thanks to Mr. J. B. Ryan of the Rocky Ford Seed Breeder's Association of Rocky Ford, Colorado, and to Dr. D. V. Layton, of the J. C. Robinson Seed Company, Modesto, California, for supplying information and certain photographs. Many helpful suggestions have been contributed by Dr. G. W. Scott of the Associated Seed Growers, Inc., Milpitas, California; Dr. J. E. Knott, Division of Truck Crops, University of California; and Dr. V. R. Boswell, United States Department of Agriculture.

15m-8,'42(1058)